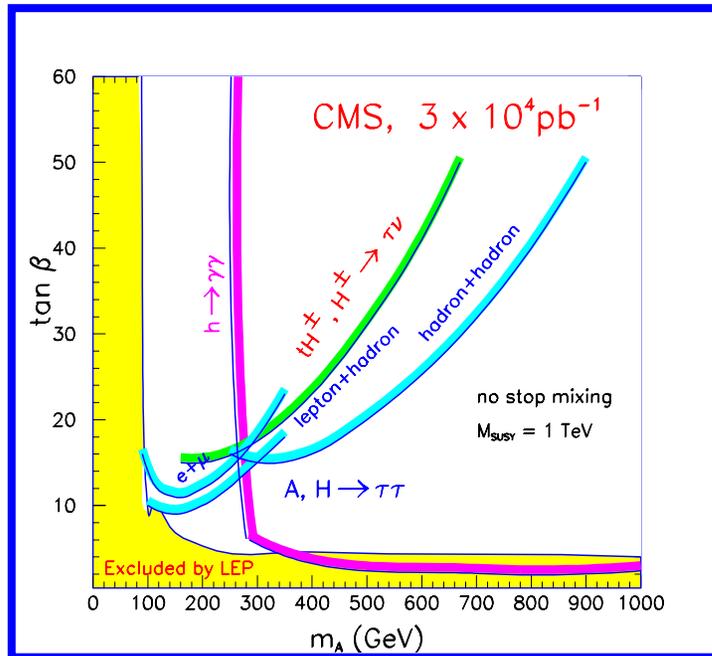


# A. Nikitenko CERN / ITEP. **Results on Tau's**

## motivation



**New L1 Tau Trigger**

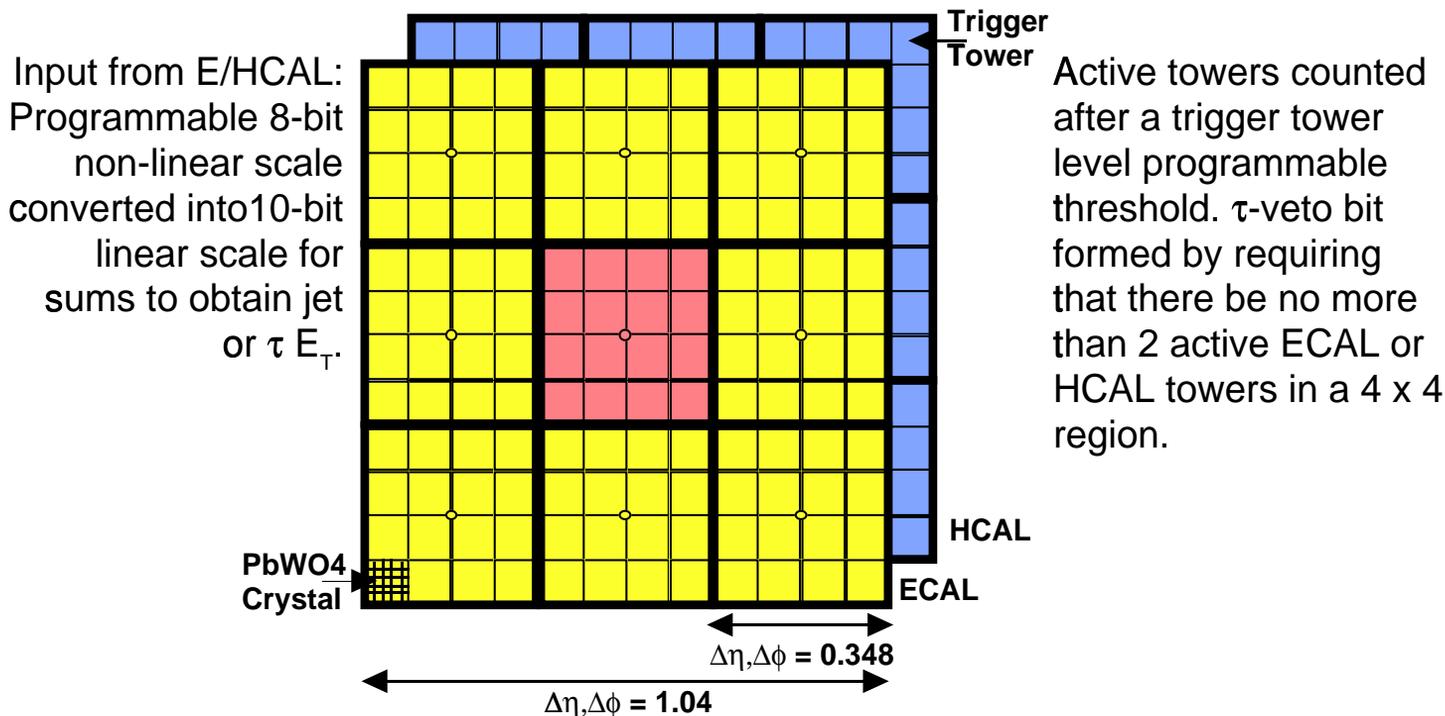
algorithm and ORCA code

by S. Dasu

**L2.0 Tau Trigger**



# Updated Jet, $\tau$ Algorithms

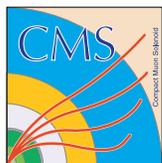


## Jet or $\tau E_T$

- 12x12 trigger tower  $E_T$  sums sliding in 4x4 steps with central 4x4 > others
- $\tau$  algorithm (isolated narrow energy deposits)**
- Redefine Jet as  $\tau$  if none of the 9 4x4 region  $\tau$ -veto bits are on

## Output

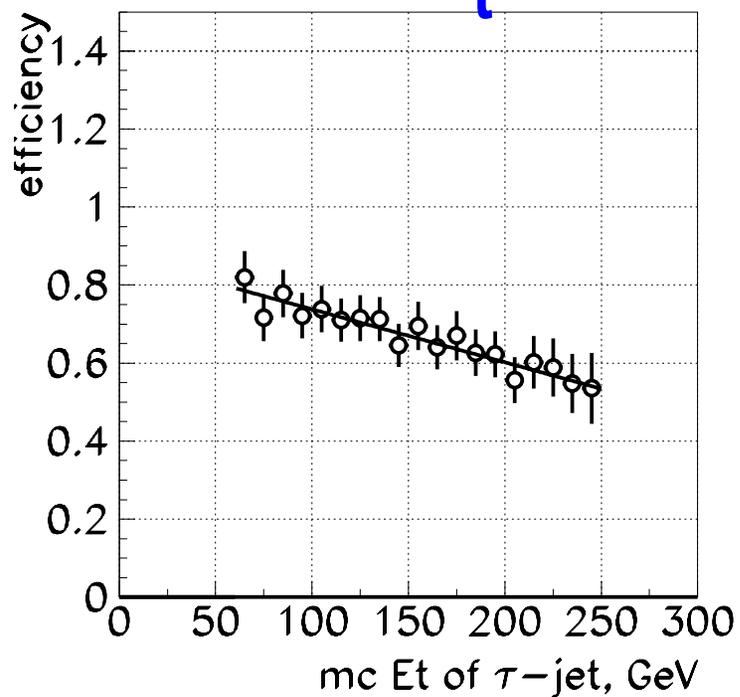
- Sorted top 4 jets & top 4  $\tau$ -jets & counts of jets above programmable thresholds



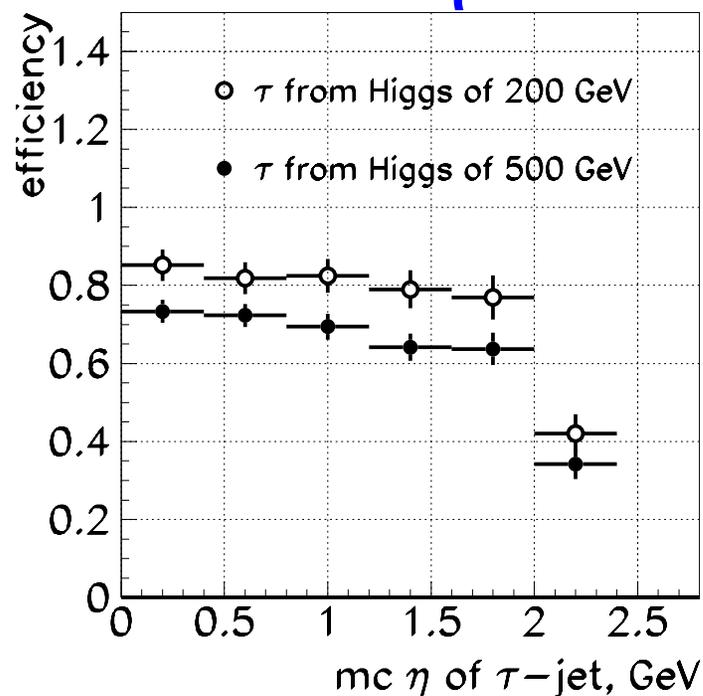
# L1 Tau trigger

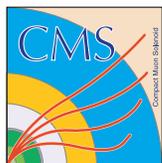
efficiency of  $\tau$ -id in  $gg \rightarrow bbA$ ,  $A \rightarrow 2\tau \rightarrow h^+h^- + X$

efficiency of  $\tau$ -id  
v.s.  $E_t^{\tau\text{-jet}}$



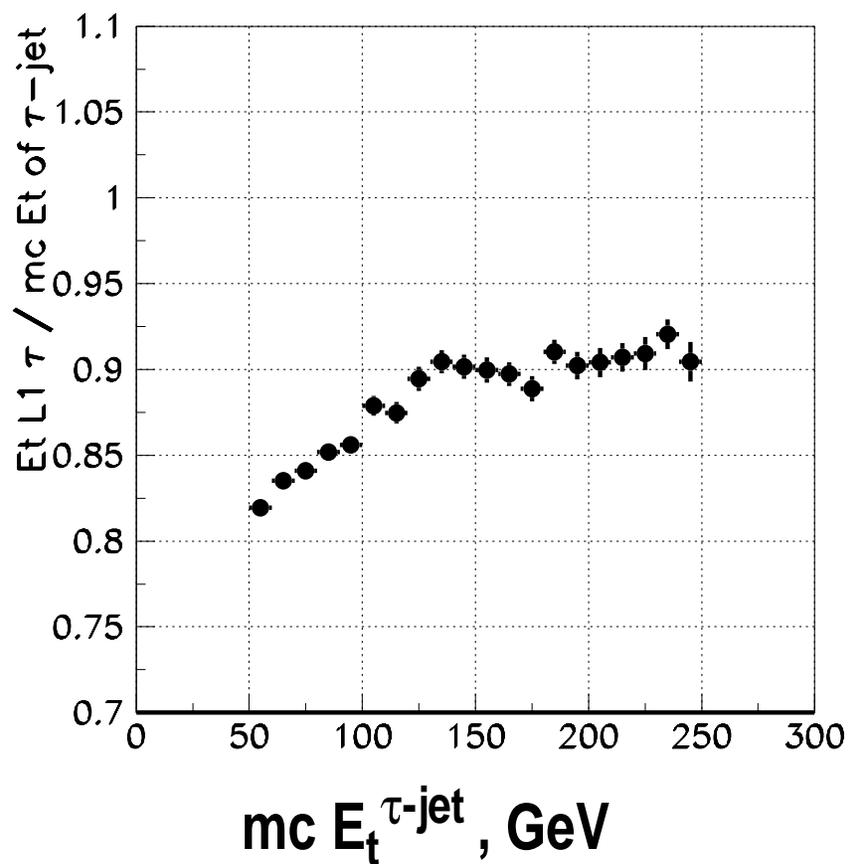
efficiency of  $\tau$ -id  
v.s.  $\eta^{\tau\text{-jet}}$



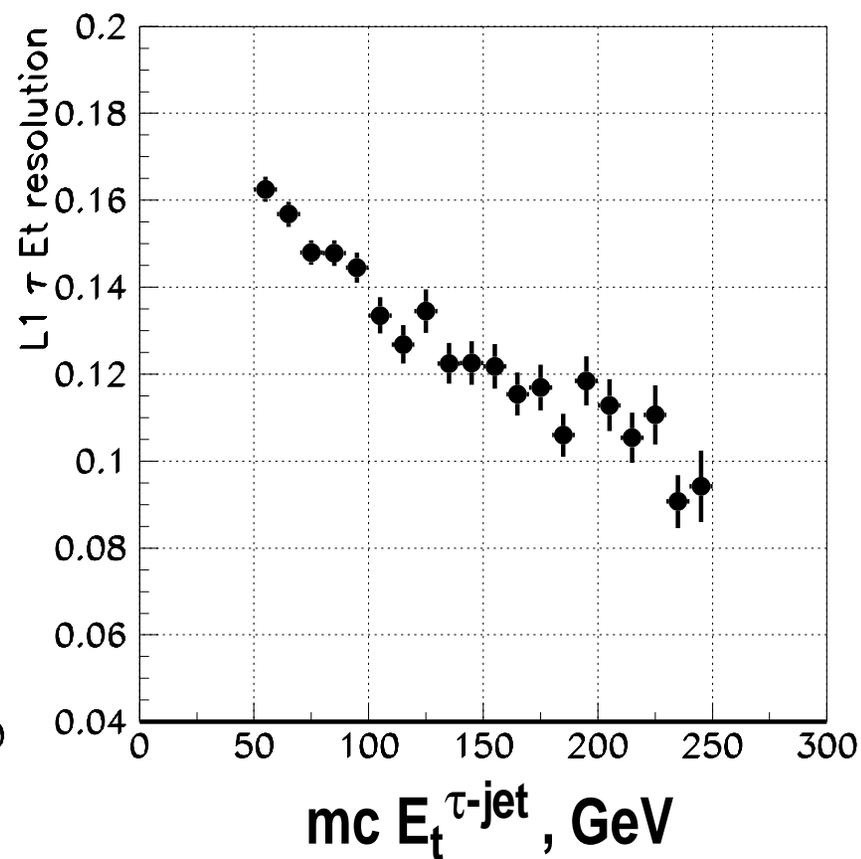


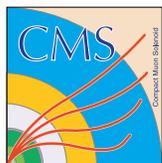
# L1 Tau trigger

$E_t$  scale:  $E_t^{L1} / E_t^{mc \tau\text{-jet}}$



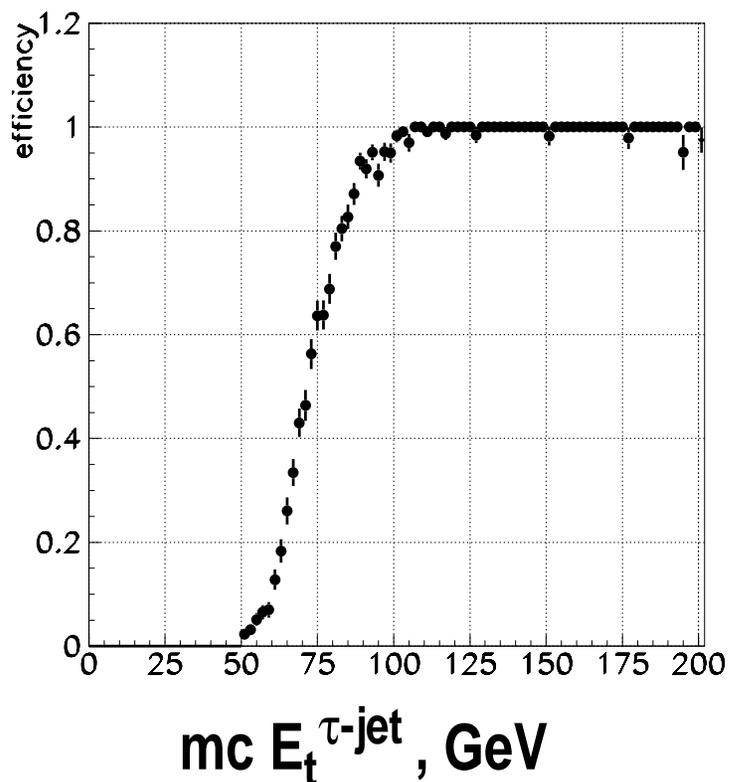
$E_t$  resolution



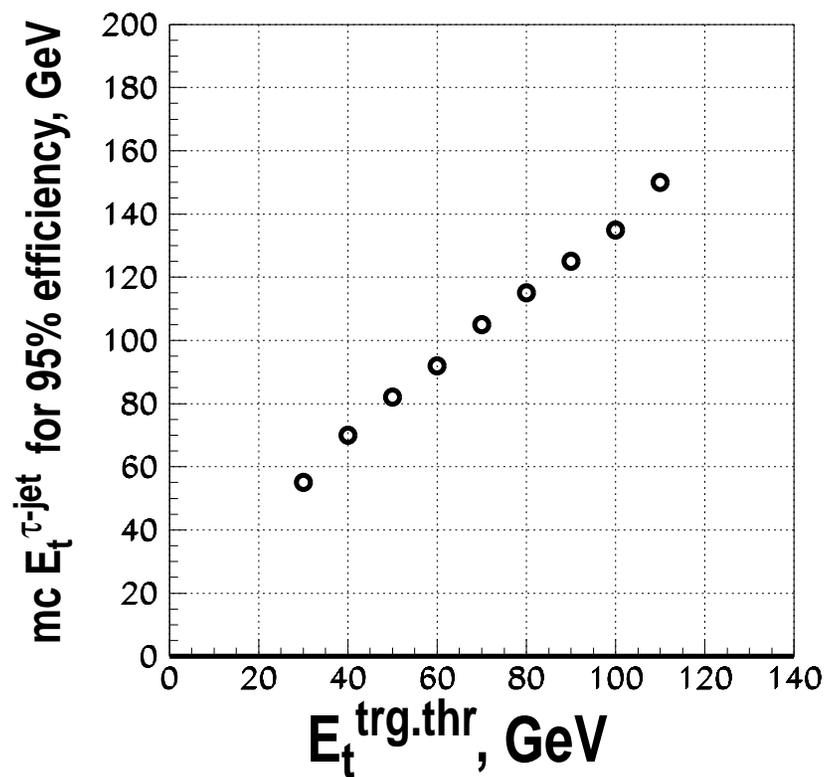


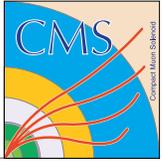
# L1 Tau trigger

efficiency curve.  $E_t^{\text{trg.thr}} = 60$  GeV



$E_t^{\text{trg.thr}}$  v.s. mc  $E_t^{\tau\text{-jet}}$  at 95% eff.





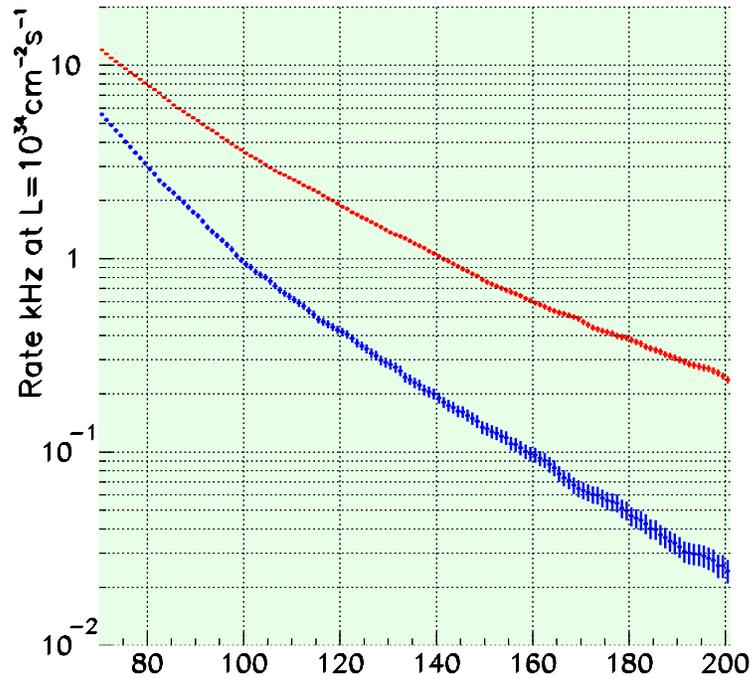
# L1 Tau trigger

Single L1 Jet Rates

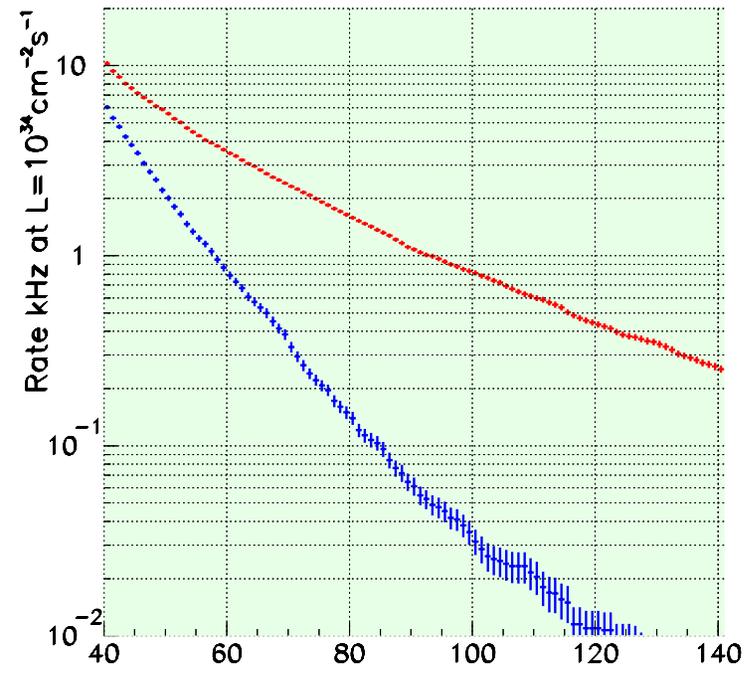
Double L1 Jet Rates

red - central Jets

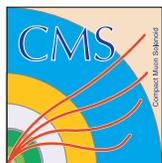
blue - Tau Jets



$E_t^{\text{thr}}$  (12x12), GeV



$E_t^{\text{thr}}$  (12x12), GeV



# L1 Tau trigger

Efficiency for  $gg \rightarrow bbA/H, A/H \rightarrow 2\tau \rightarrow h^+ + h^- + X$   
relative to “off-line” events:  $E_t^{\tau\text{-jet}} > 60 \text{ GeV}, |\eta^{\tau\text{-jet}}| < 2.4, 1 \text{ prong } \tau\text{'s}$

HIGGS MASS	OLD TRIGGER	NEW TRIGGER
200 GeV	0.29	0.64
500 GeV	0.91	0.81
L1 RATE	5.5 KHz	3.9 KHz

old trigger: 1j > 100 GeV

2j > 60 GeV

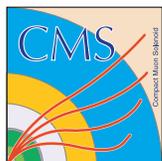
3j > 30 GeV

4j > 20 GeV

new trigger: 1 $\tau$  > 80 GeV

2 $\tau$  > 50 GeV

A big improvement with the new trigger for the low mass Higgs



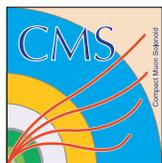
# L1 Tau trigger

**Purity of L1 Tau's in  $gg \rightarrow bbA$ ,  $A \rightarrow 2\tau \rightarrow h^+ + h^- + X$  events passed L1 and off line selections**

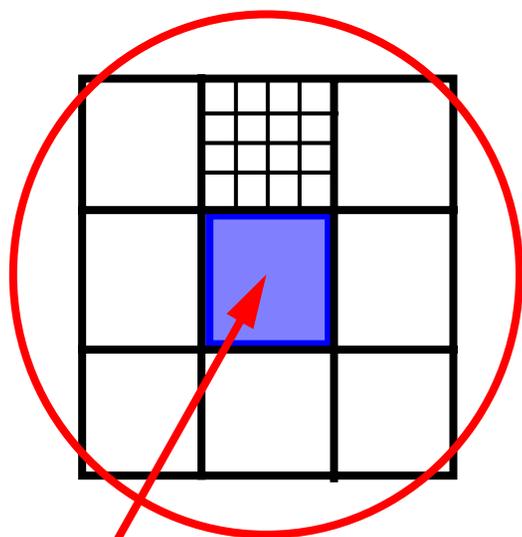
<b>HIGGS MASS</b>	<b>1-ST L1 TAU JET* IS NOT A TAU</b>	<b>2-ND L1 TAU JET IS NOT A TAU</b>
<b>200 GEV</b>	<b>(1.6+-0.5) %</b>	<b>(14.3+-0.2) %</b>
<b>500 GEV</b>	<b>(1.3+- 0.3)%</b>	<b>(45.0+-0.2) %</b>

**L2.0 Tau trigger operates on 1-st L1 Tau Jet**

\* 1-ST L1 JET IS A JET WITH A HIGHEST  $E_T$ ; JETS ARE ORDERED IN  $E_T$  IN THE TRIGGER OBJECT LIST



# L2.0 Tau trigger



$\eta, \phi$  of L1  $\tau$

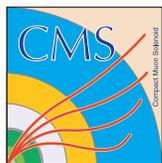
1. reconstruct a Jet\*

2. calculate e.m. isolation :

$$P_{\text{isol}} = E_t^{\text{ecal}}(R < 0.4) - E_t^{\text{ecal}}(R < 0.13)$$

3. accept event if  $P_{\text{isol}} < P_{\text{cut}}$

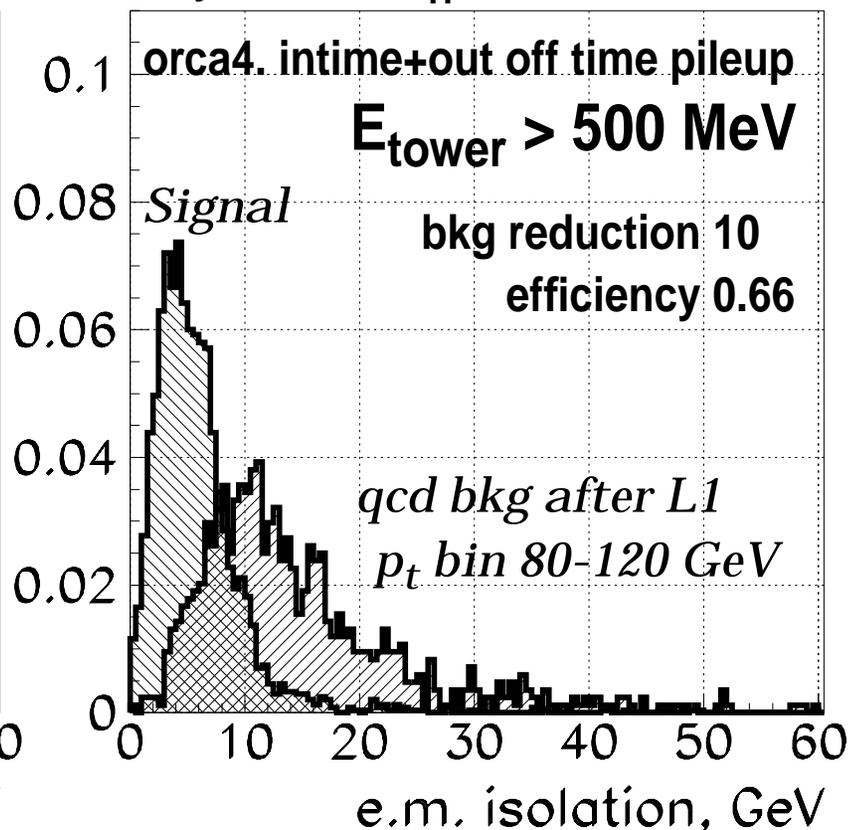
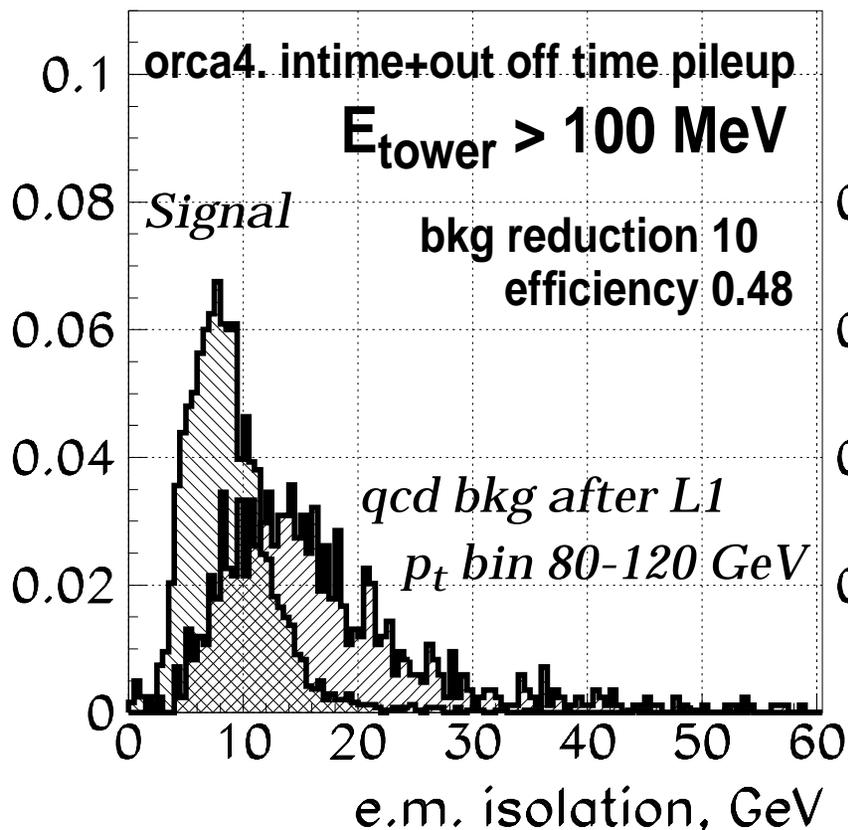
\* At L2.0 Jet is reconstructed in the location of the L1 highest  $E_t$  Tau with an iterative cone of size 0.6 and ecal+hcal towers as an input

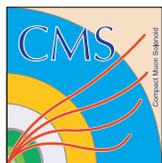


# L2.0 Tau trigger

## out off time pileup and e.m. isolation

orca3 with in time pileup only     L1 jet rate reduction    - 10  
(cms in 2000/033) :                     efficiency L2.0 for  $M_H=200$  GeV - 0.65



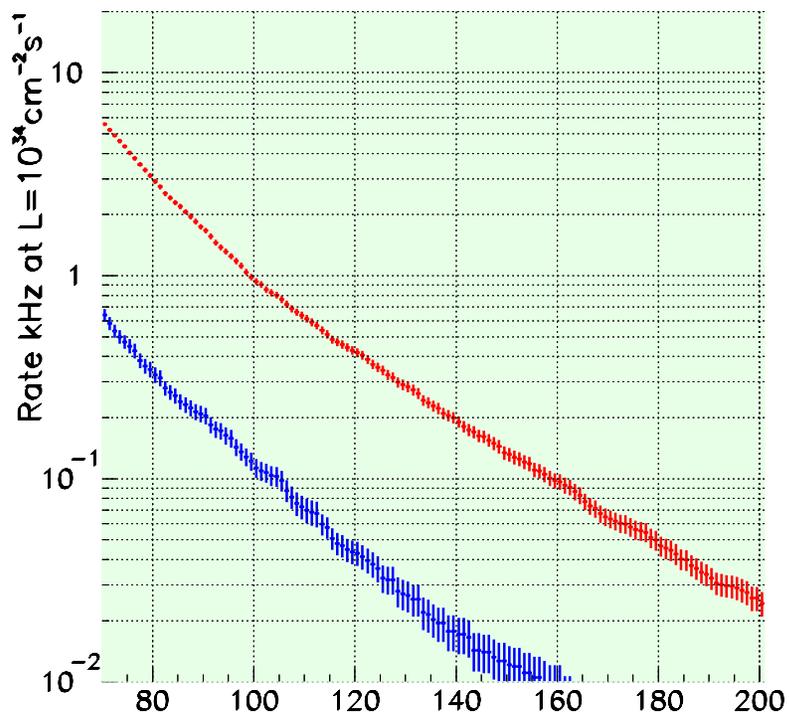


# L1 and L2.0 Tau trigger rates

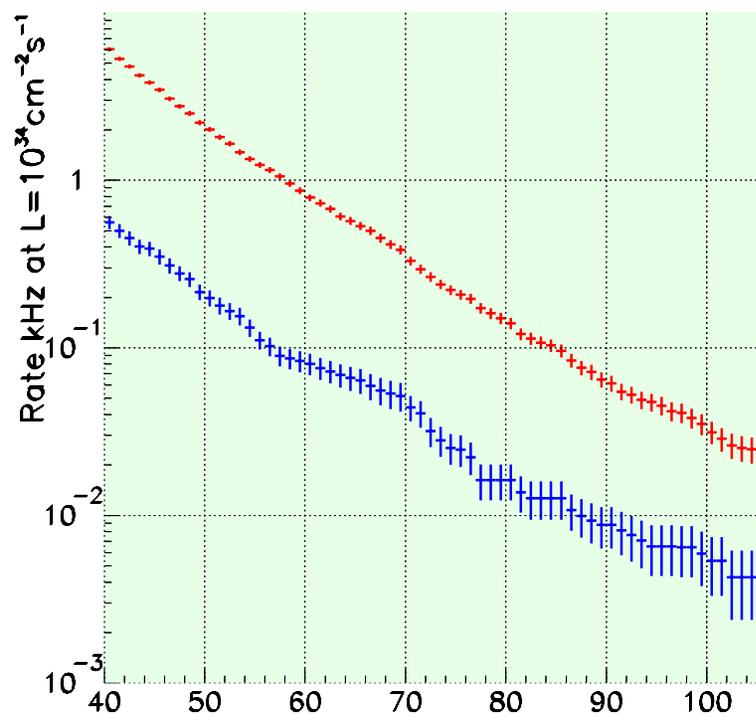
Single Jet rates

Double Jet rates

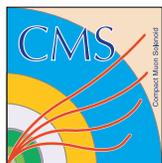
red - L1 Tau, blue - L2.0 Tau



$E_t^{\text{thr}}$  (12x12), GeV



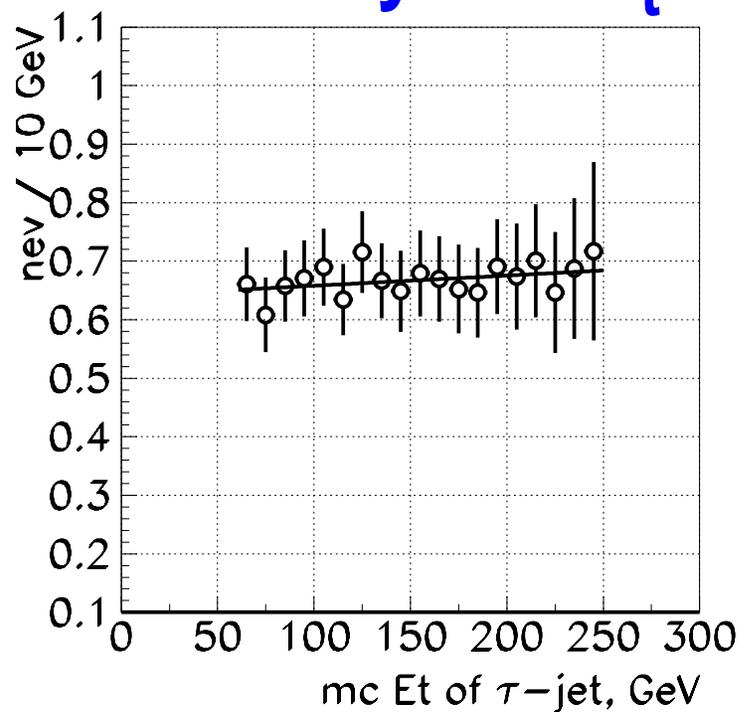
$E_t^{\text{thr}}$  (12x12), GeV



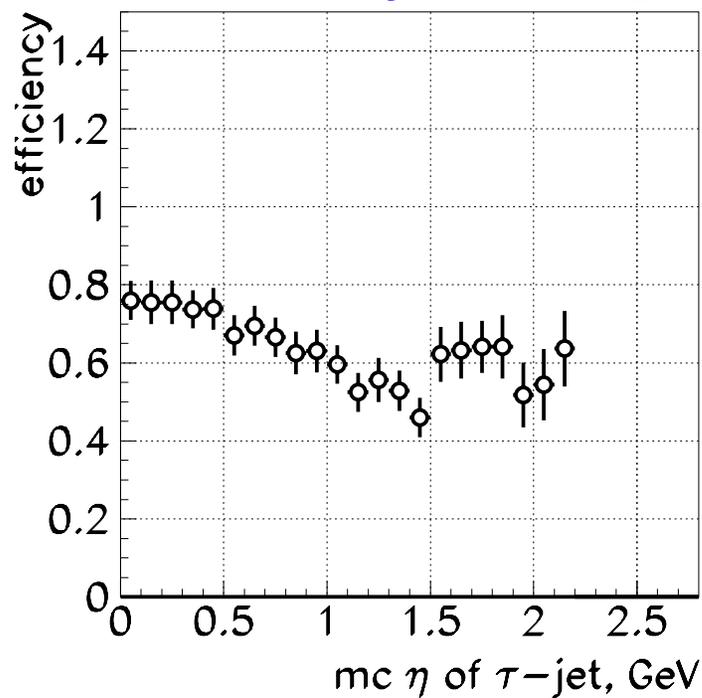
# L2.0 Tau trigger

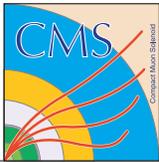
efficiency of L2.0 for  $\tau$ 's passed L1 Tau id

efficiency v.s.  $E_t^{\tau\text{-jet}}$

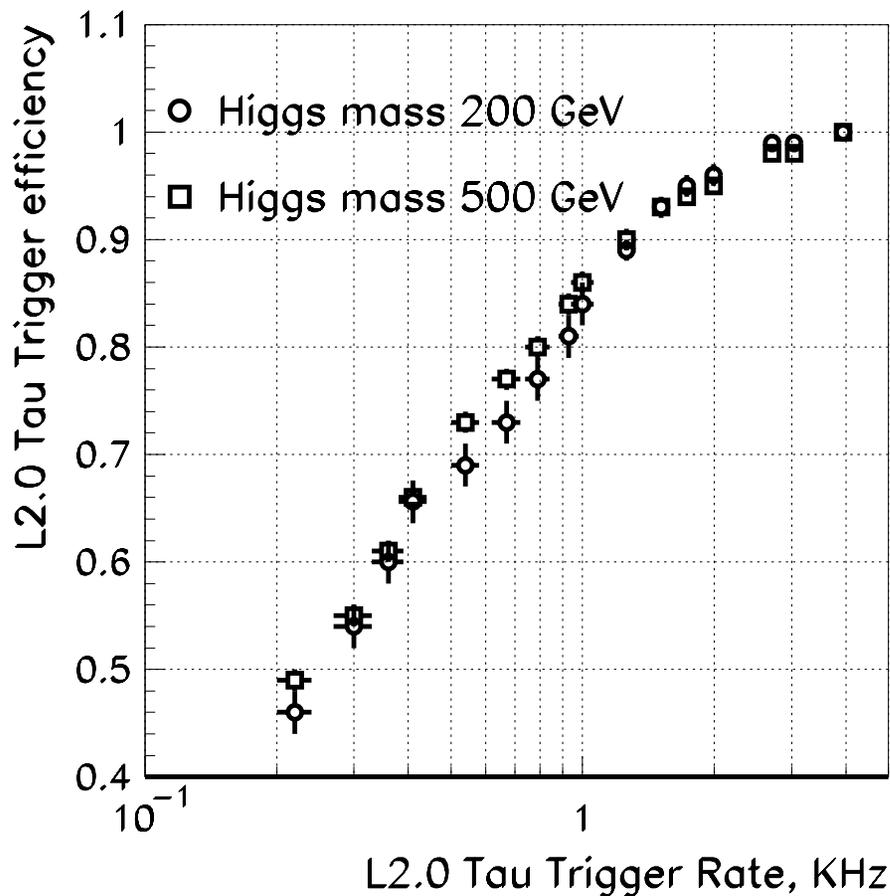


efficiency v.s.  $\eta^{\tau\text{-jet}}$





# L2.0 Tau Trigger efficiency v.s. reduction of L1 Tau Trigger rate



for  $gg \rightarrow bbA$ ,  $A \rightarrow 2\tau \rightarrow h^+h^- + X$  ev.  
passed L1 triggers :

$$1\tau > 80 \text{ GeV}$$

$$2\tau > 50 \text{ GeV}$$

“off-line” selections :

$$E_t^{\tau\text{-jet}} > 60 \text{ GeV}$$

$$|\eta^{\tau\text{-jet}}| > 2.4$$

1 prong  $\tau$ -jets